EPMedSystems

EP-WorkMate®

User's Guide

EP MedSystems, Inc.
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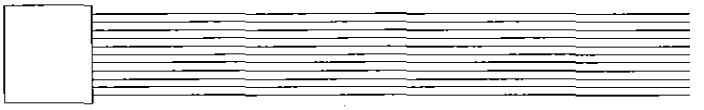

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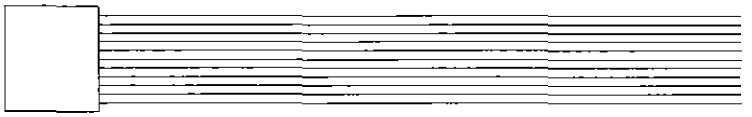

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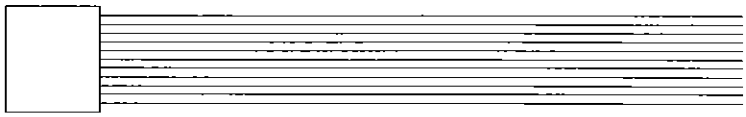

About this Manual

This manual is intended to help you get the most out of your EP-WorkMate® computerized EP system. Although you will find the EP-WorkMate easy to use, we strongly recommend that you read chapters 1 through 6 before you begin to use the product clinically. These chapters contain important information basic to the safe operation of the system as well as some time saving tips that will allow you to use the full power of the EP-WorkMate.

For information on the operation and specifications of the EP-3 stimulator, please refer to the EP-3 stimulator manual provided with the system. We strongly recommend you read the tutorial chapter before you use the product clinically.

Manual Overview

Here is an introduction into the manual's organization.

Chapter 1
Introduction

This is an introduction chapter to the EP-WorkMate. It describes the various components that make up the EP-WorkMate.

Chapter 2
User Interface

This chapter introduces the user interface of the EP-WorkMate.

Chapter 3
Getting Started

This chapter gets you started using the device and includes a tutorial on using the EP-WorkMate. This tutorial covers the basic skills needed to operate the EP-WorkMate.

Chapter 4
Review Screen

This reference chapter describes the Review Screen including the purpose and function of each menu and key. This includes stimulation and cine functions.

Chapter 5
Setup Screen

This reference chapter describes the Setup Screen including the purpose and function of each menu and key. The Setup screen defines all signals and viewed protocols. This

	includes instructions in changing the real-time monitor.
Chapter 6 **Database Screen**	This reference chapter describes the Database Screen including the purpose and function of each menu and key. The database is a key feature of this device controlling signal review, query, reporting and archiving of stored signals. The FAX utility is explained as well.
Chapter 7 **Advanced Techniques**	This chapter explains advanced concepts including unipolar signal recording, filter theory, pressure waveforms and measurements, stimulator ECG syncronization, and others. This is meant to be read after previous chapters and the EP-3 user's manual are read.
Chapter 8 **Query Utility**	This chapter explains the query utility. The query is a useful tool to search all patient data. A demo tutorial is included for practice.
Chapter 9 **Installation and Assembly**	This chapter is a description of the components and assembly of the EP-WorkMate. It is intended for bio-medical engineers and EPMedSystems personnel. It is also useful for device re-assembly after moves.
Chapter 10 **System Configuration**	This chapter is a technical description of software and hardware configuration settings. It is intended for bio-medical engineers and EPMedSystems personnel. It is also useful in troubleshooting performance problems.
Chapter 11 **Reporting**	This chapter describes the report templates and functional use of the report editor. The report editor is useful for customizing reports generated by the EP-WorkMate.
Chapter 12 **Exporting Data**	This chapter describes signal and data export capabilities of the EP-WorkMate. Data can be exported via DOS files with each signal contained in a separate file at the sample frequency.
Chapter 13 **Troubleshooting Guide**	This chapter describes troubleshooting techniques. Answers to many common questions and problems are included. Please review this chapter when in need of technical support.
Chapter 14 **Maintenance**	This chapter describes required maintenance of the EP-WorkMate. It describes preventative maintenance procedures for the product.
Appendix A **Specifications**	This appendix contains technical specifications of the EP-WorkMate.

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Vital Information

Throughout this manual critical information will be set off from the rest of the text in the following ways:

IMPORTANT

Text set off in this manner and with a tag in the margin presents important information. Information that is vital to the proficient use of the system is labeled as Important.

WARNING

A warning indicates information which is related to patient or operator safety, or possible damage to the equipment.

Throughout the manual references to particular keys on the computer display and keyboard will shown in **BOLD** type.

Definitions, Acronyms and Abbreviations

EP	Electrophysiology
EP-3	An EP stimulator
SCU	Signal Conditioning Unit (Amplifier)
PMI	Pressure/Marker Interface
CIB	Catheter Interface Box
DOS	Disk Operating System
A/D	Analog to Digital Converter
D/A	Digital to Analog Converter
Selecting	Clicking the left mouse button once while the mouse pointer is pointing to a selectable item.

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CHAPTER 1

Introduction

EP-WorkMate is a fully computerized system for capturing and measuring physiological data in the clinical electrophysiology laboratory. It provides digital signal acquisition and display of those electrical signals on high resolution monitors.

An Electrophysiology system is used to monitor and analyze surface ECGs and intra-cardiac signals. Catheters are guided into the heart and intra-cardiac electrical signals are acquired from the electrodes on the indwelling catheters from various heart locations. These signals are then used to measure irregular cardiac electrical activity that may occur in the heart. A cardiac stimulator is used to send an electrical pulse via a catheter to the heart. These electrical pulses are called pacing protocols. Pacing protocols are performed in order to reproduce any life threatening arrhythmias under the safest possible conditions for the patient. Treatment of an arrhythmia is then initiated with radio frequency ablations, drug therapy, or placement of cardiac devices that will control the heart's rhythm.

The system is also intended for recording electrocardiograms from multiple sites during clinical assessment of electrophysiological interventions. The EP-WorkMate provides on-line measurements of intra-channel intervals, and presents these measurements on the display monitor. Retrieval and display are provided without interruption of the multi-channel acquisition process. An optical disk drive (MO) or digital audio tape (DAT) is used for archival storage of digitized data.

The standard hardware configuration consists of three 21" high resolution display monitors, a Pentium™ processor, 2 Gbyte hard disk drive, 1.44 Mbyte floppy disk drive (3.5"), 2.6- 5.2 Gbyte Optical (MO) drive or 4 Gbyte Digital Audio Tape (DAT) tape drive, TI 34020 Advanced Graphics Coprocessor, 76 channel analog-to-digital (A/D) signal conditioning data acquisition module (56 intra-cardiac) with integrated pressure/marker interface, catheter interface box, EP-3

integrated stimulator, and HP LaserJet 6 series printer. Available options include: 24 intra-cardiac channel signal conditioning unit (44 total), 120 intra-cardiac channel signal conditioning unit (140 total), 32 channel strip chart recorder, cine capture, and additional slave monitors.

Menu driven software is incorporated for data acquisition, analysis, interval posting, instant retrieval with waveform markers and intervals displayed, marker editing capability, and personal form generation. EP-WorkMate has an integrated patient data base system for rapid access to all patient records. Unique features of the system include: On-line interval measurement, two channel integrated stimulator, a choice of scrolling or wiper-mode display during real-time signal acquisition, a comprehensive database with a query function, integrated RF graphics, and a user configured report editor with fax capabilities.

Functional Description

EP-WorkMate is a computer based electrocardiographic recording and monitoring system designed for efficient capture, display and retrieval of surface and intra-cardiac signals during cardiac electrophysiology studies. The system contains a fully automated software waveform detector (trigger) which performs on-line recognition of cardiac activation on pre-selected leads. Temporal interval measurements are computed on a beat-by-beat basis on multiple channels and dynamically posted on the real-time display. Intervals are calculated between waveforms from the same source on a specific channel (intra-channel measurements), and from multi-source signals across two or more channels (inter-channel measurements).

All trigger locations, with notes or annotations, as well as interval measurements are stored concurrently with the digitized signals. The following intervals are presented on the display monitor as they occur: atrial-to-atrial (AA), ventricular-to-ventricular (VV), surface QRS-to-QRS (RR), ventricular-to-atrial (VA), atrial-to-His (AH), His-to-ventricular (HV), and ventricular-to-atrial (VA). Continuous capture of the digitized signals can be invoked for any portion of the study protocol, or for the entire study. Retrieval of earlier passages of the current study, or an earlier study of the same patient, can be enabled on a secondary monitor without interruption of the real-time display. Review by protocol or by time of event can be invoked by use of user interface buttons and hot keys. Editing of computer-generated trigger markers can be done

under operator control in the retrieval mode. Archival storage of edited patient records is provided on large optical disks or digital audio tape.

Figure 1 is a picture of the EP-WorkMate Cart and its components.

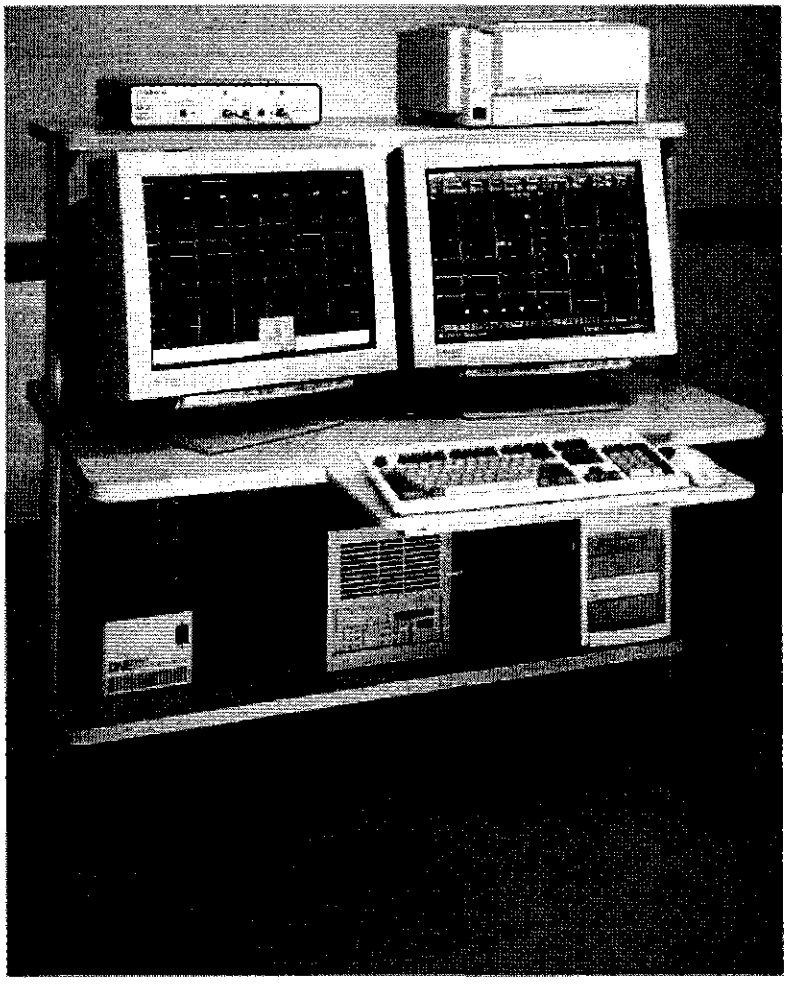


Figure 1. The EP-WorkMate Cart and Components.

WARNING

The cart pictured in figure 1 is mounted on wheels and is portable. During operation it is important to set the front wheel locks to prevent unexpected movement. Failure to do so could result in possible damage to the equipment and/or disruption of desired operation.

Figure 2 is a block diagram of most EP recording systems in use today. The cardiac signals are monitored by viewing a real time monitor, and are analyzed by viewing and measuring these signals on the review monitor. The cardiac signals are captured and conditioned with a signal conditioning unit, and then stored by the computer. The stimulator sends electrical impulses to indwelling catheters through the signal conditioning unit. The computer then sends the signals to the monitors and stores these signals for future retrieval. Significant events and user notes are also stored for each electrophysiology procedure. Electrophysiology summary reports and electrograms can be printed as desired.

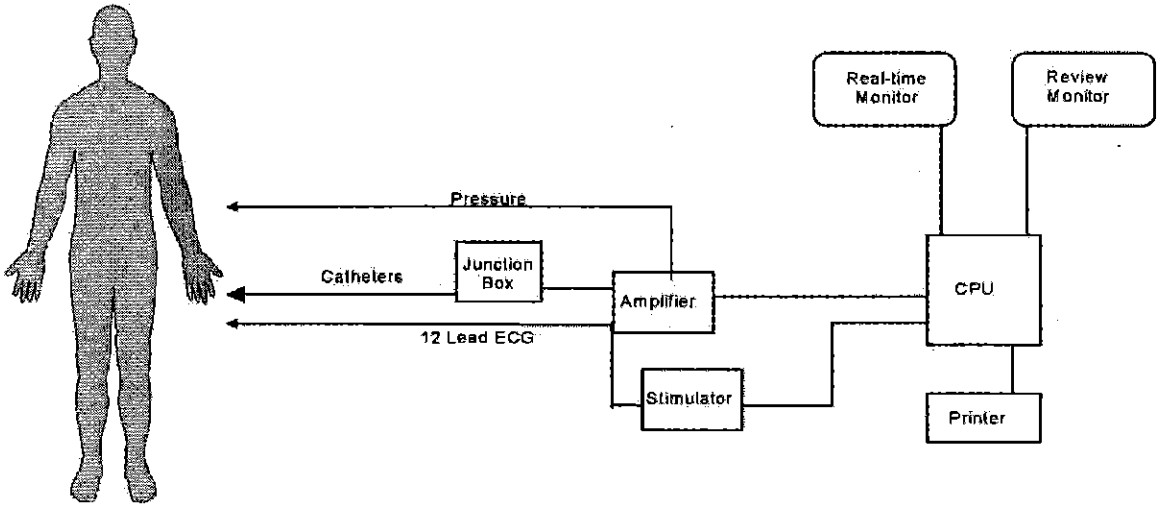


Figure 2. Basic EP Lab Connections

Operating the EP-WorkMate

Turning on the main power switch located between the monitors will power the entire cart provided the isolation transformer is plugged into an electrical outlet.

IMPORTANT

The EP-3 stimulator is powered by a battery and only charges when it is **OFF**. Care must be taken to ensure the EP-3 is charging after the cart is turned off by verifying the charging light is lit.

EP-WorkMate 24

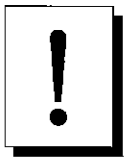
Most of this manual describes the EP-WorkMate configuration with a review monitor, a slave monitor and at least a 56 channel signal conditioning unit.

The EP-WorkMate 24 has only one monitor so all mentions of independent review and real-time monitors are not applicable. Use the split screen buttons such as **Split**, **RF**, **Holter**, and **Monitor** to control the real-time and review portions of the monitor.

Patient Connections

The patient is connected to the EP-WorkMate through a surface ECG cable, catheters and pressure transducers. These are plugged into the amplifier and the catheter junction box. These inputs are electrically isolated from earth ground. The stimulator is electrically isolated as well and is plugged into the amplifier.

Non-isolated inputs are available through the pressure/marker interface. Analog signals from other devices may be displayed using the non-isolated channels. Marker channels or pressure signals from isolated pressure amplifiers can be displayed from these inputs.



IMPORTANT

Special attention must be given to proper grounding and electrical safety. Even small chassis leakage currents passing through the heart can induce fibrillation. Never connect non-isolated inputs or outputs directly to a patient. A functioning defibrillator should always be available.

WARNING

The stimulator back panel connectors and the pressure/marker interface box are NOT isolated. Never connect them directly to a patient. Always plug external devices into an isolation transformer.

User Interface

EP-WorkMate consists of two independent 21 inch, high resolution screens as well as a keyboard and a mouse for control of data acquisition, storage, and retrieval of electrophysiological signals. The main monitor is dedicated to real-time visualization of signals. Signals which can be accommodated are typically surface ECG, intra-cardiac signals, stimulation markers, and output of blood pressure transducers. Automated wave form recognition and interval measurement are available for any of the electrocardiographic signals. The page number is also displayed.

The secondary monitor is used as a menu-driven review console for display and retrieval of data from either the current study or a previous study contained in the patient data base.

The presentation of menus provides for selection and control of system features. These features may be either mouse or keyboard activated and include such options as:

- Catheter or lead identification,
- Choice of location, size, and color of the signal display,
- Selection of signals to be automatically analyzed,

- Entry of customized study protocols,
- Enabling or disabling permanent storage of signals and measurements onto system storage media.

The review monitor serves as the display medium for previously recorded data. In the Review screen, any portion of the recorded file can be accessed by event marker, time of event, or by scrolling through in a continuous or page-by-page mode. Other options available in the Review screen are a Holter screen, zoom capabilities, post acquisition filtering, and automatic analysis.

Cautions and Disclaimers

EP-WorkMate detection algorithms contain a sophisticated software trigger for electrocardiograms. However, the accuracy of trigger placement and interval measurement cannot be guaranteed, particularly in the case of poor signal quality. Therefore, verification of trigger locations and associated measurements is required on the part of the user before full confidence can be placed in reports produced by EP-WorkMate's automated analysis.

The equipment is intended for use by qualified medical personnel and only after they have been trained in the proper use of this equipment.

EPMedSystems, Inc. does NOT assume responsibility for damage to the equipment caused by improper ventilation, improper or faulty power, or improper monitor booms.

For continued safety, it is necessary that the instructions listed in this manual are followed. It is important that instructions in this manual in no way supersede established medical procedures concerning patient care.

Federal law restricts this device to sale by or on the order of a physician.

WARNING

EXPLOSION HAZARD. Do not use this equipment in the presence of flammable anesthestic.

WARNING

Installing un-approved software or operating system on the EP-WorkMate hard drive may severely affect system performance and device safety.

Turning Off the EP-WorkMate

Exit the software to the main menu using the user interface navigation techniques presented in the following sections.

Always remember to return the main stimulation menu before turning off the EP-3 to save changed protocols.

WARNING

EXIT THE SYSTEM VIA THE MENU-DRIVEN SELECTIONS BEFORE TURNING THE POWER OFF. Advanced buffering techniques are used for both the database and real-time acquisition. Simply turning off the system or a power failure while running the system could cause loss of data.

The Millennium

The EP-WorkMate and EP-3 stimulator are fully compliant with year 2000 requirements. For all database fields in the EP-WorkMate, the century is stored with all dates. February 29, 2000 is recognized as a leap year, and all date calculations such as patient age utilize the century allowing the age to be more than 100 years.

CHAPTER 2

User Interface

The user interface consists of two monitors performing separate tasks controlled by a single mouse/trackball. Each monitors' interface is defined in detail in sections below.

Mouse Control

The mouse/trackball controls a mouse pointer that moves around on the screen as the user moves its' controlling device. It will also move from monitor to monitor. The mouse pointer will partially disappear on one monitor as it appears on the other. The orientation of the monitors is important. If the real-time monitor is left of the review, moving the mouse to the left on the real-time will not wrap around to the review monitor. Of course moving it to the right will move from the right edge of the real-time to the left edge of the review. If the monitors are reversed, the opposite will happen.

The left mouse button always selects the item that the mouse pointer is pointing to. It is used to select menu items, buttons, move annotations, store intervals to the database, edit signal attributes, move review screen traces, edit database fields and a variety of similar functions.

The middle mouse button is used to change the attributes of the item the mouse pointer is pointing to. It is used to edit annotations, mark log entries, move calipers and similar functions. When the mouse pointer is not pointing to an editable item, it invokes the previously invoked caliper in the review screen. Thus pressing the middle mouse button in the review signal area when not pointing to an annotation or caliper interval will pop-up a caliper.

The right mouse button is used to remove any currently viewed menu or text input box. Thus the right mouse button returns to the previous level of menus.

Buttons

Each major task or control feature is implemented by a button. Clicking the left mouse button on one of these control buttons performs its function. When the buttons are not accessible, they are either removed from the screen or turn a different color.

One of the letters of most buttons are a different color than the others. Pressing that letter or **Alt**-letter will invoke the button function.

Menus

Menus may appear when a button is selected. Menus display lists of options when appropriate. The right hand side of all menus contains a scroll bar allowing the user to move through the list of options quickly. One of the these options within the main menu is always highlighted. The highlighted option can be changed by selecting the **Up Arrow** and **Down Arrow** buttons above and below the scroll bar, respectively. These buttons can also be used to view options not listed currently on the screen.

Pressing the left mouse button when the cursor is over one of the options will place a check mark to the right of that option. Pressing the right mouse button or striking the **Return** key will enter that option into the appropriate position on the monitor.

Pressing the right mouse button will always remove any menu from the screen.

When any menu is displayed simply typing the desired option will highlight that option if it has been previously defined.

Selecting the **EDIT** button at the bottom of all menus will display the menu editor. The menu editor allows the user to insert new and delete unwanted menu options. These options are listed in two columns, the left column is labeled 'Menu Used for Screens' and the right column is labeled 'Menu Used for Forms.' 'Menu Used for Screens' entries will be displayed on the menus within the EP-WorkMate screens. When any of these menu selections are printed onto reports, their corresponding entry in 'Menu Used for Forms' will be printed.

Selecting the **INS**(Insert) will prompt the user to type in the new menu item. That item is stored by pressing **Return**.

Selecting **DEL** (Delete) to delete the highlighted choice.

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Yes/No Inputs

A Yes/No Input Box is displayed when a selected function may result in unwanted results (e.g. when deleting a patient's data from the memory). A question is displayed within the box along with two buttons labeled 'Yes' and 'No.' Most questions are worded so that 'Yes' is the desired response. Striking the **Return** key will always answer 'Yes.'

Text Inputs

A Text Input Box allows the user to enter free form text into the selected area. Striking the **Return** key or pressing the right mouse button will enter the input.

On the EP-3 keyboard there is both a **Return** key and a **Enter** key. Use the **Enter** key to insert a carriage return or new paragraph into a comment. On a normal PC keyboard the right **Ctrl** key performs the same function.

Keyboard

The main purpose of the keyboard is to control the EP-3 stimulator. However, all alphanumeric keys can be used to select buttons or functions and enter data. All function keys and the keys on the right side of the keyboard control EP-3 functions.

WARNING

Care should be taken to avoid spillage of liquid onto the keyboard. This could cause the keyboard to become inoperable during operation. Use a plastic shield if there is a chance of this happening in your environment.

The EP-WorkMate Main Menu (Shell)

Introduction

The Main menu appears when the computer is turned on. To initiate an option select the appropriate label by pressing the left mouse button.

Begin/Review Study

Selecting this option will initiate the EP-WorkMate software. This is the choice you will select the majority of the time.

Archive Log Files

Selecting this option displays the Archive Log Files Utility. This utility allows previously recorded patients to be stored to either a 2.6-4.8 Giga-byte optical disk (MO) or a 4.0 Gbyte Digital Audio Tape (DAT).

Before selecting this option, place an optical disk or digital tape into the correct drive. The EP-WorkMate will prompt the user to name the disk if it already has not been previously named and will automatically calculate the free

disk space available. Patients' data that will fit onto the disk will have a check mark to the right of their names. Striking the **Menu/Esc** key or pressing the right mouse button will begin the downloading process after confirmation. The Main Menu will reappear when the process is complete.

Restore Log Files

Selecting this option will load a patient from the DAT to the EP-WorkMate's hard drive (cases cannot be reviewed from the DAT).

NOTE: This is only for those systems with DAT storage capabilities.

Before selecting this choice, place the digital tape into the digital tape drive. The EP-WorkMate will initially ask if the user desires to restore all of the patient's on the tape. If 'NO' is selected then the EP-WorkMate will prompt the user to select the patient's desired to be restored. Type the patient name or press **Return/Enter** for a list of patients on the EP-WorkMate. If the patient has more than one procedure, select the ones to be restored. The system will then restore the files to the EP-WorkMate log files. If the patient has been deleted from the database, use catalog below to find the patient on the tape.

Restoring the files will take a few minutes. The EP-WorkMate Main Menu will appear when the files have been restored.

Catalog Tape

Before selecting this choice, place the digital tape into the digital tape drive. After selecting this option the patients that have been stored on the DAT will be listed on the screen. Striking the **Return** key on a specific patient will restore that patient to the hard drive and database. If it asks you to restore additional patients, press N.

Edit Menus

Selecting this option will allow the user to print, edit, or view all of the user definable menus (e.g. catheters, events, etc...) used by the EP-WorkMate.

The Menu Editor screen will display **Edit/View Menus** or to **Print Menus**. Print Menus will print a list of all menus available

To edit or view a selected menu, first select the menu. The selected menu will then display two different categories:

MENU USED FOR SCREENS are the screen menus used

with the EP-WorkMate.

MENU USED FOR FORMS displays the way that menu choices will be presented in study reports. Thus on the screen the data can be shown in an abbreviated form and on the report the data can be printed in an expanded way (in sentence form for example).

To edit a menu category or insert a new menu entry, select **Edit/View Menus**. Then select the menu title you want to edit. To insert a new menu entry, select **INS** for insert. The new entry will be inserted above the screen bar cursor in the menu screen. To edit a menu category, select the entry with the mouse or screen bar cursor and a free text screen allows you to change or modify the name. To enter, click the right button, or press **Return/Enter**.

To delete a menu entry, highlight the entry with the screen bar cursor and select the **DEL** (for delete) button. The menu item will be removed from the menu.

The **Default** button will set the item currently highlighted by the cursor to be the default menu item which is the highlighted item whenever the menu is selected without previous data.

The **Alphabetize** button will alphabetize the screen menu.

The **Print** button will print the displayed menus to the printer.

To escape the menu editor, as usual press the right mouse button or **Menu/Esc** and choose to store or not to store any changes you made.

System Maintenance

System Maintenance starts a software self-diagnostic test that will look for problems and compress all system database files. The test will search for errors with database files and report any problems and re-organize the files. Please call technical support with any problems found.

Backup System

Before selecting this choice, place a backup optical disk or digital tape into the drive. When this function is selected, the contents of your hard drive will be copied to the digital tape or optical disk. The backup will take a few minutes.

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Restore System

Before selecting this choice, place the most recent backup tape or disk into the drive. This will restore the system **AS IT WAS THE LAST TIME THE SYSTEM WAS BACKED UP.** All data stored in the patient database or catheter map database since the last backup will be lost. Be sure you want to do this before proceeding. This operation will take a few minutes to perform.

WARNING

Restoring should only be done after extreme system failure or under direction from technical support. All recently stored data will be erased/over-written.

Communication Test

This option runs a diagnostic test of the communications between the main computer and the signal conditioning unit. It is helpful in diagnosing cable, connector or board failures. This test utility measures the packet transmission rate between the amplifier and the main computer. The results will be in packets transmitted and total errors occurring. Errors can only occur if packets(data) are lost during transmission because of a communication error causes by hardware, software or cabling problems.

Technical Support

This function is useful in diagnosing software problems experienced by the user as well as for software upgrades. It allows for modem connection with engineering technical support at EP MedSystems, Inc.

First, select Technical Support from the EP-WorkMate Menu. The review screen will show the modem initializing and then a message stating "Waiting for Connection" will appear. Next, connect up the telephone line to the Line slot of the Modem in the back of the EP-WorkMate computer. This jack will have a picture of a phone plug-in-jack or be labeled "LINE".

The EP-WorkMate is now ready to receive a call from Technical Support at EP MedSystems, Inc. Please contact EP MedSystems, Inc. to request a Technical Support communication call after these steps have been completed.

The EP-WorkMate will return to EP-WorkMate Menu (Main Menu) after EP MedSystems, Inc. has finished their communication session. If it is not at the main menu, turn the computer off and back on before using the EP-WorkMate

again.

Query DataBase

Selecting this function allows the user to search the entire patient database for specific, patient defined data. For instance, a list of all patients that had a left postero-septal accessory pathway can be obtained, or a list of all the cases a Josephson catheter was used. For more information see the section titled **Performing a Query** in chapter 8.

FAX Utility

The FAX utility is where reports can be sent via the EP-WorkMate's FAX-modem. Selecting this function from the main menu allows the user to select the desired pages to be FAXed as well as their destination. For more information see the section titled **FAX Utility** in chapter 6.

NOTE: All EP-WorkMate functions will be inaccessible while FAX-ing occurs.

The EP-WorkMate Screens

Introduction

The EP-WorkMate main application can be broken down into three screens. The Review screen, the Database screen and the Setup screen. Each screen may then have multiple windows.

A screen is defined by a control button area at the top and sometimes bottom, a data presentation area in the middle and a message display area at the bottom.

Real-time Monitor

The real-time monitor displays signals continuously for the signals defined in the Setup screen. The signals are grouped into **6** pages of up to **32** channels. The pages can be controlled using the up and down arrows in the upper right hand corner of the review monitor.

Note: The EP-WorkMate 24 does not have a separate real-time monitor. Use the **Monitor** split screen button defined in the review screen keys section.

Review Monitor

The review monitor is used to view stored signals, along with a log of events, the stimulator and a holter window. Buttons along the top and bottom of the screen control how the signals are reviewed and annotated.

Hot Keys

The EP-WorkMate has dedicated keys for fast operation. Many of the keys defined below are not listed on the screens.

Review Screen

Middle Mouse	Pop up the previous caliper on the review screen.
M	Mark a real-time event in the log.
~	Reset the SCU notch filter.
Ctrl-A	All auto record features enabled.
Ctrl-B	View the signals for the previous log entry.
Ctrl-C	Horizontal caliper.
Ctrl-D	Drugs and sedation pop-up menu.
Ctrl-E	Print 12 lead at 25mm/sec.
Ctrl-F	Print 12 lead at 50mm/sec.
Ctrl-G	Print 12 lead view of review screen.
Ctrl-H	Enter or exit DEMO mode.
Ctrl-I	Creates a slide of the current screen in PCX format.
Ctrl-J	View the signals for the previous event.
Ctrl-K	View the signals for the next event.
Ctrl-L	Begin level triggered sweep.
Ctrl-M	View the signals for the last log event.
Ctrl-N	View the signals for the next log entry.
Ctrl-O	Creates a slide of the current screen in JPG format.
Ctrl-P	Display CINE split screen and play the top CINE window.
Ctrl-Q	Record the currently viewed real-time screen.
Ctrl-R	Start recording from the past.
Ctrl-S	Change stimulator screen format.
Ctrl-T	Begin stim triggered sweep.
Ctrl-U	Move review monitor page to the last page stored (or currently viewed on the real-time screen).
Ctrl-V	View the signals for the first log event.
Ctrl-W	Change review screen speed.
Ctrl-X	Decrease review screen speed.
Ctrl-Y	Horizontal single caliper.
Ctrl-Z	Increase review screen speed.
Ctrl-2	Print review screen to fit.
Ctrl-6	Save demo mode signals.
Ctrl-up arrow	Review monitor page up.
Ctrl-down arrow	Review monitor page down.
Ctrl-left arrow	Review left one page.
Ctrl-right arrow	Review right one page.
Alt-left arrow	Review scroll left.
Alt-right arrow	Review scroll right.
Shift-left arrow	Split or holter screen left one page.
Shift-right arrow	Split or holter screen right one page.
Shift-up arrow	Split review page up or faster scroll for stimulator parameter.
Shift-down arrow	Split review page down or faster scroll for stimulator parameter.
Alt-up arrow	Review channel amplitude up.
Alt-down arrow	Review channel amplitude down.
Ctrl-number pad 2	Real-time monitor page up.
Ctrl-number pad 4	Real-time monitor speed decrease.
Ctrl-number pad 6	Real-time monitor speed increase.
Ctrl-number pad 8	Real-time monitor page down.
Ctrl-number pad 3	Real-time channel amplitude up.
Ctrl-number pad 9	Real-time channel amplitude down.
Alt-function keys	Select protocols.
Ctrl-function keys	Select events.
Ctrl-number pad dash or Manual Stim	Toggle strip chart records on and off.

RF Split Window

Ctrl-B	Previous session.
Ctrl-N	Next session.

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Setup Screen	~	Reset the SCU notch filter.
	Ctrl-A	All button to make same change to all in column.
	Ctrl-C	Copy the current screen to the memory copy buffer.
	Ctrl-E	Put a full 12 lead page on the current screen.
	Ctrl-I	Creates a slide of the current screen in PCX format.
	Ctrl-N	Add a new channel.
	Ctrl-O	Creates a slide of the current screen in JPG format.
	Ctrl-V	Paste the screen from the copy memory buffer onto the current page.
	Ctrl-X	Clear the current channels.
	Ctrl-F1 to F4	Activate stimulation markers for next channel of A-,A+,B-,B+.
	Ctrl-F5 to F8	Increase pressure offset for channels 1-4.
Database Screen	Ctrl-C	Clear the entire page of catheters.
	Ctrl-D	Change the date the study is stored under.
	Ctrl-I	Creates a slide of the current screen in PCX format.
	Ctrl-N	Change the log directory number (use with extreme caution).
	Ctrl-O	Creates a slide of the current screen in JPG format.
	Ctrl-T	Change the name of the optical disk or tape the study is stored to.

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CHAPTER 3

Getting Started

This chapter will give you a good understanding of the fundamentals in using the device.

Power On

The main power switch for the entire cart is located on the power strip usually located between the two monitors. The power switch for the stimulator is located on the front panel of the EP 3.

User Interface

The user interface consists of two monitors performing separate tasks controlled by a single mouse or trackball. For the remainder of this manual the terms mouse and trackball are interchangeable.

Mouse Control

The EP-WorkMate's functions may be activated through the display buttons presented on the screens. A menu option is activated by placing the cursor on the option and pressing the LEFT mouse button. Also, simply typing the single highlighted character in all the displayed options will select the associated menu item.

Menus

Menus appear for many button selections. Some menus scroll because they contain more items than can be shown in the allocated space. Selecting the up and down arrows on the scroll bar will move the cursor up and down. Clicking in the scroll bar will also move the cursor.

Pressing **Return/Enter** selects an item and **Menu/Esc** (the **Menu** key on the EP-3 keyboard) returns to the previous level.

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The Basics of Electrophysiology Studies

Introduction

An electrophysiology (EP) study defines the type of protocols that will occur during an EP procedure. Protocols define the names for the catheters and their pins, and the location of catheters in the heart. Protocols also define the types of diagnostic test such as stimulus and types of treatment such as drug therapy or RF ablation.

The purpose of the EP-WorkMate is to combine these types of protocols, and make the changing of the protocols simple as well as events that will occur during the study.

Defining an EP Study and its Protocols

In order to define a study, the user should first name the study type. The user would first go into the **Setup** screen and setup the pages as required. Six independent pages of 32 choices are allowed per protocol. On each protocol page the names and positions of these channels are defined. The amplitude, high and low pass filter settings, analysis type, catheter pins, and screen color are also specified on the Setup screen. Finally, we will define our Holter channel, our synchronization channel for our stimulator and the pacing sites for the stimulator

Then save the study using the **Save CathMap** button with the appropriate name of the study and press **Return/Enter** to store the name.

Next the user would then label or name the study's protocols. To define a protocol name or label, we would select the **Protocol** button. One can modify the existing names in the defined protocols screen by selecting **EDIT**, this will display the existing protocol names in the EP-WorkMate. Selecting a protocol name replaces the edited protocol.

Selecting **DEL** (delete) erases the defined protocol name from the menu.

Selecting **INS** (insert) adds a new protocol to the defined protocol list. Select the protocol label to be inserted.

While in this menu pressing **EDIT**, will allow the user to add, edit or remove protocols on the main protocol menu. To add a new label select **INS** and type in the name and press **Return**. Select **YES** to add the new label to the menu. To delete a label, select **DEL** and the label will be removed. Press **Menu/Esc** to exit. The screen will then ask if you want to store any changes made. Select **YES** to save changes.

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The **DEL** button erases the current protocol along with its channel setup and pages.

Repeat these steps until the protocol list is complete for the study type. Then using the **Copy** and **Paste** functions add the initial setup to all the selected protocols and Save them with the correct study name as initially selected

It should be noted that once a page is defined in a protocol, only minor variations of that page are generally made for most of the other protocols of the study type. These types of changes are often small and require little work once the protocols have been defined.

Beginning an EP Study

After selecting **Begin/Review Study**, enter the patient's name (last then first with no commas) then press **Return/Enter**. The system then displays a list of the patients on the hard drive you can select from this list if the patient has had a previous study or select the patients name from the top of the list. The next input field is the patients ID number. It should be noted that the only information required to save a study is the patient name and ID number. Finally a list of the catheter maps currently stored is displayed. Select the map and the EP-WorkMate will go directly to the first page and protocol of the selected catheter map. All other entries are optional. If you wish to enter further demographics go to the database function **B**.

The Database screen is for entering patient demographics, generating reports, and for patient study management. We can either begin a study for a new patient, or for a previous patient. When entering new patient information, press **Return/Enter** after typing in the patient's name and you will be led through the succeeding database fields. Study date and time and tape/disk catalog # will be entered automatically. A unique patient name/ID number must be entered for each patient. Many other fields have user definable menus and do not have to be entered.

After selecting the type of study, go to the Setup screen and verify the signal information for the real-time screen such as name, position, size (Amp. for amplitude and Clip for clipping limit), high and low pass filters, color, box and +/- for catheter inputs, analysis types, and any output signals. Also verify the signals on the following pages by selecting the up and down arrows in the upper right hand corner of the Setup screen. This is the point where you may make any minor adjustments necessary to that catheter map.

Recording an

After we have set up the real-time signals, we are ready to

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EP Study

begin recording the study. Select the **Review** button, and choose either **Start /Stop REC** OR **Auto REC** to begin recording.

The Start/Stop REC is the manual record. When the system starts any recording it displays in the bottom right of the display the amount of time recorded as well as the free time remaining on the hard disk. To stop recording, select the **Start/Stop REC** button again. One important option is **Past+(Ctrl-R)** which will acquire the previous 30 seconds and keep recording. When the **Start/Stop** button is activated the start window displays red and the bottom of the screen turns yellow until you stop recording, when they return to their original color.

The **Auto REC** (automatic record) will begin recording automatically for four defined triggers. Two of them are the rate or the beats per minute (bpm) based on a **High** or **Low Rate**. Thus if the patient goes outside a range of heart rates, the EP-WorkMate will begin recording until the bpm falls back inside the pre-defined high and low rates as defined in the background Setup screens. One option is **Stim. Train** (stimulus train) which automatically records on the sensing of the stimulus train as defined in the Setup screen. The amount of time to record before and after the stimulation event is defined in the background Setup screens. The final option is **RF** (radio frequency ablation) which automatically start/stops recording on detecting RF energy from supported RF generators. The time to pre and post RF recording is defined in the background Setup screen. The **Auto REC** button turns red when it is activated until the auto record functions are switched off.

Recalling an EP Study

To recall an EP study first go into the Database screen and press the **Select Patient** button. Scroll down until the right patient is highlighted and press **Return/Enter**. Next, press the **Select Study** button and select the desired study date. The last study date is always selected for you by default. If there is only one study, there will be no drop down screen and the study recorded will be automatically selected as it is the last one recorded. If you have multiple patients on the hard drive you can select a patient by entering the first letter of their last name and the list will automatically jump to that letter.

Recalling an EP Study on the hard drive or optical disk

The simplest method to find a patient with signals located on the hard drive or optical drive is to first go into the Database screen and press **New Patient**. Then press **Select Study** and pick either the hard or optical drive. Scroll through the list of available patients until the desired

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patient is highlighted and press **Return/Enter**.

The Stimulator Window

Selecting the **Stim** button or any **Function** key or the **Menu\Esc** key will invoke the stimulator window. Make sure the stimulator module is turned ON. The operation of the stimulator is defined in the EP-3 User's Manual supplied with the system.

Scrolling In the Review Screen

Use the bottom scroll bar and the bottom right buttons to scroll through the stored signals and to change the viewed page. If you press the left mouse button on the single < or > icons, this will scroll through forwards or backwards through the recorded data. If you click on the << or >> this will move a page at a time forwards or backwards. Finally if you click on the ⇐**E** or **E**⇒ icon the system will jump from event to event as recorded in the log.

LOG

Select the **LOG** button to see a history of all events recorded during the study. Using the left mouse button, select any item in the log list to view the signals for that event. It is also possible to delete, edit and filter various lines from the log. Filtering involves the ability to show all of the recorded events or just the events or just the protocols to allow the user to search and use the log more efficiently.

See the "LOG Window" section for more details.

Triggered Sweep

When performing induction stimulation trains, it is useful to see last beat of the drive train updated automatically on the review screen. By selecting **Stim Train** from the auto record menu this can be done automatically. The point where the screen refreshes is the blue triangle at the screen bottom. Select a new trigger point with the left mouse button or by dragging the triangle to the desired location. Now start a stimulation train and watch the review screen update at the end of each train. For this function to work one channel in any of the catheter map pages must be a stimulus channel with the auto analysis set to Stim and the correct pins assigned for the channel.

The Split Screen

This allows for two review screens to be placed side by side for comparison of electrograms. Press **Split** to display the split screen window. Press it again to remove it. Both windows open, function independently. To select either review screen, click on the screen or the scroll bar. The right review screen will be the screen that updates with current recorded electrograms for comparison.

The Holter Window

Another split screen option is the holter window. Press **Holter** to display the Holter window. Press it again to

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remove it. This shows the entire case from start to finish in a compressed one channel view. Selecting any portion of the Holter view signal will display the signals recorded at that time in the study.

Operation Overview

The following is a step by step description to begin and perform an EP study.

- Turn the entire EP-WorkMate system **ON** using the main power button between the two monitors.
- Select **BEGIN NEW STUDY** and input a patient's name and ID number. It will show a menu of patients currently on the hard drive. Pressing the right mouse button will remove the menu and add the patient as a new patient. Clicking on a patient name with the left button will select that patient for re-study. Next pick the type of study to perform from the list of catheter maps displayed.
- Select the **Database (b)** button and enter the patient's other demographic information by selecting the database field on the screen.
- Select the **Review (R)** button to return to the review screen.
- Select the **Stimulator(S)** button and turn the EP-3 ON. Verify the self test performs correctly.
- Select the **Real-time 12 Lead ECG** key. The review is automatically updated and a 12 Lead ECG is recorded and sent to the printer.
- Once the catheters are in position, record data by either pushing record hot key or update screen hot key. This will display intra-cardiac signals on the review screen. Select the single horizontal caliper button and use the left mouse button to measure intervals on a specific channel, then click the **camera** icon. Measurements will be stored in the log and in the database under measurements.
- Press the **F1** key and perform a threshold test for the current pacing catheters using the **STIM** key. Be sure to turn the EP-3 pacing site output switches **ON**.

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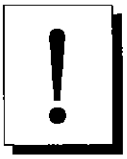
- Remember to change **Protocols** as you jump through the different stages of the case. This will help you manage the log information more efficiently.
- Using the stimulator press the **F8** key to perform arrhythmia induction (mapping) stimulation pacing trains. Press the **MENU** key and corresponding **F** or **P** function keys to select new pacing protocols and perform them at will. Use the **Start REC** button to start and stop recording as needed, or use the **Auto Record** features so the system will start and stop recording for you.
- Note: Stim analysis must be present in one of the Setup screens for the Stim channel to automatically update the review screen.
- Use the **Event** and **Notes** buttons to mark events while saving or while reviewing signals. Use the **M** key to mark events quickly even if not saving.
- Use the scroll bar at the bottom of the screen with its left and right page arrows to move around through all stored signals. Use the **LOG** menu to navigate through the stored signals.



IMPORTANT

Before turning off the EP-WorkMate, first turn off the EP-3 stimulator by returning to the stimulator protocol menu of the stimulator (press the **Menu\Esc** key). Now turn off the stimulator using the front panel power switch. Now select the **Exit** button and return to the main menu. Now it is safe to turn the entire system OFF using the main power switch usually located between the two monitors.

Failure to turn off the EP-3 stimulator at its main menu can result in loss of all P-key stored stimulator protocols.

CHAPTER 4

Review Screen

The Review screen is the first screen that is drawn once the Begin/Review Study has been selected from the Main Menu. The review screen displays all stored signals with intervals and events annotated, operates the stimulator, and records the study. The following are the buttons displayed on the review screen with their corresponding action.

NOTE: Hot Key functions can be turned on and off by the same key.

Exit
'x'

Selecting this button will return the user to the main menu. If any data has been recorded without a patient name entered, the EP-WorkMate will prompt the user enter a name at this time and may prompt to save changes to the catheter maps. If the EP-WorkMate is accidentally powered down and patient data has been recorded without a patient name, the EP-WorkMate will restore the data automatically. If this occurs while recording, at most the previous 2-3 seconds of data may be lost.

NOTE: When the Exit button is selected the EP-3 stimulator is no longer functional.

Monitor
'r'

Selecting the **Monitor** button will display the real-time signals on the right most review window. You can activate this by selecting the **Monitor** button on the top left of the screen, or by pressing the **R** key. This will start a "sweep" mode real-time display of current electrograms. These electrograms do not have to be recorded but recording is available. Additionally, you can use the "Split" function to monitor in on the right side of the split, and review on the left side. When using the "Split" function with the new monitor mode and the new stimulator on the bottom of the review screen, you can see your stimulation parameters, triggered updates based on the last paced beat and real-time electrograms, all on one monitor.

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Database **'b'**	Selecting the **Database** button will display the Database screen. Please see more information about the Database screen below.
Setup **'u'**	Selecting the **Setup** button will display the Setup screen. Please see more information about the Setup screen below.
Stim **'S'**	Selecting the **Stim** button will display the stimulator window. Please see more information about the Stimulator below as well as from the EP-3 manual
Holter **'H'**	Selecting the **Holter** button will display the Holter window in a split screen fashion on the left or right side of the review monitor. The Holter channel is defined in the Setup screen. At any time during or after a study a different Holter channel may be selected. **NOTE:** It may take several minutes to load a new Holter channel. The channel name will display 'Loading...' when a new channel is loading and display the channel name when finished. Pressing the left mouse anywhere in the Holter signal area will highlight the ECG with a small white box and display the corresponding ECG in the Review screen. The Holter screen window has many of the scrolling review buttons as the review screen.
Split **'I'**	Selecting the **Split** button will display a second Review screen to the left of the initial Review screen. Both screens will function independently, the right screen will display updated ECGs when triggered and the left screen will display user selected ECGs fixed in time.
Cine **'n'**	Selecting the **Cine** button will display the Cine window on the review screen. Please see more about the Cine window below.
RF **'F'**	Selecting the **RF** button will display the RF window on the review screen. The RF screen allows the user to view the RF data in graphical and numeric form. Please see more about the RF window below.
LOG **'L'**	Selecting the **LOG** button will display a window on the review screen containing color coded events including: Stimulation events, RF events, High and Low Rate events, user selected annotation, protocol changes and measurements. Please see more about the log window below.

Print
'P'

Selecting this button will display the available print options. Included in these options are printouts of the signals as viewed in the Review screen, the RF data, three different 12 lead formats, PCX files for further manipulation on either a PC or Macintosh, continuous printing beginning with the data displayed for those former strip chart users and finally an option to send all printouts to the FAX utility (see FAX utility above).

Print Review(Fit) prints the current review screen exactly as shown on the screen.

Print Review prints the current review screen at the speed it was recorded. Because the review monitor is usually wider than the laser printer paper, the right most signals may not print.

Print Continuously prints the current review screen using the split review screen.

Note: The split review screen must be used to define the beginning(on the left) and ending(on the right) signals when performing the export or print continuous functions. The **Menu/Esc** keys can be used to abort either function.

Protocol
'c'

Selecting this button displays a list of the current protocols available for the selected CathMap. These options can only be edited when in the Setup screen (see below).

Notes
'o'

Selecting this button displays a text input box. The user can type into this box an annotation specific to the ECGs displayed in the Review screen. This annotation will remain fixed with this data and will also be placed into the log.

Once an annotation is entered, it can be picked up by moving the cursor over it and pressing the left mouse button and moved to any point in the Review screen, within the Signal Viewing Area. Releasing the annotation is accomplished by pressing the right mouse button.

Events
'E'

Selecting this button displays a user defined menu of frequently used annotations. Selecting one of the options displays a text input box allowing for further annotation. The first twelve events is associated with the function keys. When striking the function keys at the same time as the **Ctrl** key, the associated event appears as described above. If recording, the user will be prompted to answer a Yes/No Input box asking whether the event is to be placed with the data in the Review screen or the data in the Real-time

screen.

Drug Syringe 'Ctrl-D'

Selecting this button will display a menu displaying the options: 'Study Drug ON,' 'Study Drug OFF' and 'Sedation'. Selecting the 'Study Drug ON' option will display another menu of study drug options. Selecting a study drug will display a text input box prompting the user to enter the drug's dosage. Once this process is completed the Syringe button will turn red until the 'Study Drug OFF' option has been selected. Selecting the Sedation option will display a different menu for sedatives. Selecting a sedative will display a text input box prompting the user to enter the drug's dosage.

All Drug events are entered into the log and database automatically. Sedatives entered will be summed and displayed on the 'MEDS' database page.

Camera Icon

Selecting this icon will only work after several specific measurements have been selected with the Single Line Caliper (see 'Single Line Caliper' below). These measurements include, on a surface lead, P, Q, R, S, T, P and Q again. The tick marks placed by the caliper must all lie on the same surface lead. Moving the caliper to the signal labeled as the 'atrial' channel, measure the A-A interval. Moving the caliper to the 'HIS' channel measure the A-H and H-V intervals. Finally, move the caliper to the 'ventricular' channel measure the V-V interval and select the 'Camera' button. Notice that a Database Measurement menu appears and all of the proper measurements are in their proper locations.

Utilizing this button allows the user to take advantage of a quick and easy method for selecting and entering baseline measurements without having to question the validity of those measurements.

Intervals 'v'

Selecting this button will toggle on or off the automatic on-line analysis of the analyzed channels as defined in the Setup screen.

Horizontal Caliper

'Ctrl-C'

Selecting the horizontal caliper will display a caliper in the Review screen that measures time in milliseconds(ms) from one point to another. To make a measurement select the horizontal caliper and move the left leg of the caliper to the desired ECG and press the left mouse button. The left leg of the caliper has turned yellow and become fixed. Roll the right leg of the caliper, by moving the track ball, to the end of the desired interval and press the right mouse button. To remove the calipers press the right mouse button again.

Using the calipers in this manner allows the user to make repeated measurements over and over and does not enter any of these measurements into the database.

Entering a measurement into the database is done in exactly the same manner as making a measurement except when fixing the right leg of the caliper the left mouse button should be pressed again. A menu will appear on the screen. Select with the left mouse button the description of the interval just measured and then press the right mouse button. The measurement has been entered.

Releasing any caliper leg can be accomplished by pressing the right mouse button. The right leg of the caliper can be set first by pressing the middle mouse. Releasing fixed calipers is done by pressing the middle mouse when the cursor is placed over the caliper's measurement.

Vertical Caliper

Selecting this button will display an amplitude caliper that measures voltage in mV or pressure in mmHg. It functions exactly as the horizontal caliper above with the caliper rotated 90 degrees. This measurement does not store with the signals.

Single Line Caliper 'Ctrl-Y'

Selecting this button will display a single line with a triangle adjacent to it. This special caliper measures time in milliseconds from one point to another point on the same channel. To make a measurement, move the triangle to the starting point of the measurement and press the left mouse button. Next, move the triangle to the end of the interval being measured and press the left mouse button again. Notice that when the left mouse button is selected a 'tick' is left on the signal chosen by the triangle. The measurement between the two ticks will be displayed on the left hand side of the right most tick. Pressing the left mouse button again on the same signal will display another tick with another value in ms displayed. This new value is the measured interval between it and the closest tick to its left on the same signal.

Pressing the right mouse button will display the original cursor. Pressing the middle mouse while the cursor is placed to the left of any tick will 'pick up' that tick and display a Single Line Caliper.

Arrow '/'

Selecting the Arrow button displays a pointing hand on the Review screen as the mouse cursor. The hand can be moved to the point in time in the Review screen where the arrow is to begin with the track ball. Pressing the left mouse button will begin the drawing of the arrow and

display an arrow head at the end of the arrow. Pressing the left mouse button again will fix the arrow. Pressing the middle mouse when the cursor is over the box displayed in the middle of the arrow will pick up the arrow and allow its end point to change. When the arrow is active (blue) pressing the right mouse button will erase it from the screen.

The Arrow works very much in the same fashion as the Single Line Caliper.

Caliper Off
Arrow Head

This button removes any calipers or arrows fixed on the screen as well as terminating any active calipers or arrows.

Auto REC
'A'

Recording will automatically begin when four pre-defined criteria are met. The first is when any stimulation is given by the stimulator. The EP-WorkMate knows to begin recording because stim markers can be seen on the stim channel, therefore a stim channel must be setup on at least one of the six catheter map pages. The second is when the heart rate falls below a preset, user defined interval. The third is when the heart rate accelerates above a preset user defined interval (the previous two are triggered from a channel with R-R analysis enabled). The fourth is when the RF generator begins sending data to the EP-WorkMate via the serial COM-2 or COM-B cable.

The PRE-RECORD TIME is the recorded signal time before the event. The POST-RECORD TIME is the recorded signal time after the event. Both times must add up to less than 31 seconds. In other words, the pre-record time can be up to 21 seconds if the post-record time is 10 seconds. If you do not want the recording to automatically terminate, set the post-record time to 0. The DETECTION LIMIT is the interval in milli-seconds that triggers the event. For stimulation it is normally set to 1000, high rate to 400 and low rate to 1500. The DETECTION COUNT is the number of intervals above or below the limit to trigger the event. This is normally set to at least 3 for high and low rate.

The **EDIT** button in the 'Auto REC' menu allows the user to setup the parameters of the auto record functions. When the pre-defined criteria are met the EP-WorkMate automatically labels the event that occurred in the log.

All of the auto record functions can be turned on or off by striking **Ctrl-A**.

Start REC
't'

When the **Start Rec** button is selected a menu appears with three options. The first option is simply 'Start.' Selecting

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this option will begin recording until the user turns it off. The second option is 'Screen.' Selecting this option the EP-WorkMate will record enough data to fill the rhythm strip as if a 12 lead were being printed The final option 'Past +' will record to memory the previous 30 seconds of data as well as recording indefinitely until turned off by the user.

All of these functions will update the Review screen when chosen.

Trigger 'g'

One of the unique features of this product is its ability to trigger the update of the review screen via stimulation trains or an attained signal voltage level. Selecting the **Trigger** button displays a menu with two choices.

Stim Train: The first option is 'Stim Train.' When this option is selected a blue triangle with a vertical line above it appears at the bottom of the Review screen. When stimulation is given the last stimulus delivered will be displayed at the blue triangle. This triangle can be moved to any point on the screen by simply pressing left mouse button when the cursor is over it and dragging it to the desired point or pressing the left mouse button at the new desired location at the bottom of the Review screen. Selecting **Stim** using the **Auto REC** button will perform this function automatically in addition to recording.

Voltage Level: The second option 'Voltage Level' allows the user to view the signals beat to beat in a fixed position in the review screen. Selecting this option initiates recording and displays a horizontal single line amplitude caliper. When this caliper is moved to the desired signal to be triggered from, the screen updates at the intersection point between the caliper and the triggered sweep triangle indicator at the bottom of the screen. For example placing the caliper on the QRS of a surface lead will place the QRS in the exact same screen position every time the screen is updated. When the screen is updating consistently in the correct position (if the caliper is set too close to the baseline of the signal the EP-WorkMate may become confused and update inconsistently) press the right mouse button.

Note: Saving signals is optional during triggered sweep. You do not *have* to record during triggered sweeps. Turn the auto-record feature off and use the triggered sweep button **Trigger** to select a sweep mode. Recording can be started during any triggered sweep if needed by pressing the **Record** key, the **Save** button at the bottom of the window, the mark key **M**, or **Ctrl-R.**

Show
'w'

Selecting this button will display a menu listing several options. This function works in conjunction with the triggered sweep. It is only active when the triggered sweep is turned ON. It allows the user to make fast visual comparisons of triggered ECGs. Two or more triggered ECGs can be overlaid for a fast visual comparison. The overlay feature takes the first, previous, or all triggered electrograms from the triggered sweep, turns them gray and overlays them with the most recent ECGs.

Real-time Monitor Controls

This group of buttons on the top right hand side of most of the EP-WorkMate screens controls the characteristics of the signals in the Real-time screen.

Speed
'd'

Selecting this button will display a menu listing the available choices for the sweep speed of the real-time screen in mm/sec.

Mode
'Ctrl-M'

Selecting this button will change the way that new data is presented on the Real-time monitor. Two options are available. We call them 'wiper' mode and 'scroll' mode.

The 'scroll' mode places all new data on the right edge of the monitor moving all previous past data to the left.

The 'wiper' mode fixes all new data onto the screen with the newest data overwriting previous data by a vertical line that moves from left to right.

Real-time Page Up ↑
'Ctrl-num pad 8'

Selecting this button will display the next, lower page number on the Real-time screen (e.g. page 3 to page 2).

Real-time Page Down ↓
'Ctrl-num pad 2'

Selecting this button will display the next higher page number on the Real-time screen (e.g. page 2 to page 3).

Amplitude Up
A↑

Selecting this button will increase the amplitude of every signal displayed on the Real-time screen.

Amplitude Down **A↓**	Selecting this button will decrease the amplitude of every signal displayed on the Real-time screen.

Review Scrolling Controls

	Previously recorded data can be viewed using the scrolling controls at the bottom of the Review screen.
Review Scroll Bar	The display in the review scroll bar displays the point in time that the currently displayed data was recorded. Selecting any other location in the scroll bar with the left mouse button will display the data for that point in time.
Replay	Selecting this button will replay the currently displayed review image on the real-time monitor at the current displayed speed. This is useful to view signals exactly as they were recorded real-time. The signals will continue to display until the **Replay** button is pressed again or until about 30 seconds elapses.
Previous Event **E** ←	Selecting this button will display the data corresponding with the previous event marked in the log.
Event Menu **E**	Selecting the event menu button will display the entire log in a free text box allowing the user to select edit previously recorded events. Use this when the **LOG** split window cannot be used.
Next Event **E** →	Selecting this button will display the data corresponding with the next event marked in the log.
Review Page Left <<	Selecting this button will display in the review screen one page of data previous to the one currently displayed.
Review Scroll Left <	Selecting and holding this button will continuously scroll through data previous to the data currently displayed.

Review Scroll Right >	Selecting and holding this button will continuously scroll through data following the data currently displayed. **Note:** The rate of scroll can be varied using the background Setup entries SCROLL WAIT and SCROLL PIXEL SHIFT. To adjust these press the **Setup** button twice to enter the background Setup screen. For slow smooth scrolling set SCROLL WAIT=0 and SCROLL PIXEL SHIFT=4. For faster block moves set SCROLL WAIT=300 and SCROLL PIXEL SHIFT=128.
Review Page Right >>	Selecting this button will display in the review screen one page of data following the one currently displayed.
Review End of Signals >|	Selecting this button will display the last page of signals stored.
Speed	Selecting this button will display a menu listing the available choices for the sweep speed of the review screen.
Amplitude Up A↑	Selecting this button will increase the amplitude of all of the signals displayed in the review screen.
Amplitude Down A↓	Selecting this button will decrease the amplitude of all of the signals displayed in the review screen.
Review Page Up Ctrl-up arrow	Selecting this button will display the next, lower page number on the Review screen (i.e. page 3 to page 2).
Review Page Down Ctrl-down arrow	Selecting this button will display the next higher page number on the Review screen (i.e. page 2 to page 3).